

### EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Jeffrey Howell on September 17, 2009.

The application has been amended as follows:

In the Claims:

Claim 2. (Currently Amended) An electrolytic apparatus for use in an oxide electrowinning method, said apparatus comprising:

an annular electrolytic vessel made of a metallic material and having an annular space with a bottom formed therein and an upper portion;

a high frequency induction coil for heating a substance to be processed in said electrolytic vessel;

an annular anode installed at the bottom of the annular space formed in the annular electrolytic vessel;

rod-shaped anodes and rod-shaped cathodes installed in the upper portion along the axial direction in the annular space and arranged in parallel, the rod-shaped anodes and the annular anode being arranged vertically;

a first electrolysis controller connected between the rod-shaped cathodes and the annular anode, and

a second electrolysis controller connected between the rod-shaped cathodes and the rod-shaped anodes,

wherein one of a parallel pair of the rod-shaped anodes and the rod-shaped cathodes arranged in parallel or and a vertical pair of the annular anode and the rod-shaped cathodes arranged vertically is used for main electrolysis and the other of the pairs is used for auxiliary electrolysis.

Claim 4. (Currently Amended) A spent nuclear fuel reprocessing method with an oxide electrowinning method by using the electrolytic apparatus according to claim 2, wherein the oxide electrowinning method comprises:

a simultaneous electrolytic step, including dissolving uranium oxide contained ~~in a large amount~~ in a spent nuclear fuel into a molten salt in the annular electrolytic vessel due to an anodic oxidation reaction, and simultaneously recovering uranium oxide by depositing uranium oxide on the surface of the ~~cathode~~ cathodes due to cathodic reduction;

a dissolution step by chlorination in which the electrolytic step is stopped, including dissolving uranium oxide, plutonium oxide and other elements remaining in the spent nuclear fuel into the molten salt by blowing chlorine gas into the molten salt to convert the uranium oxide, the plutonium oxide and other elements remaining in the spent nuclear fuel to chlorides thereof; and

a MOX recovery step, including performing electrolysis between ~~one of~~ the anodes ~~doubling as a crucible~~ and ~~one of~~ the rod-shaped cathodes installed in the upper portion of the ~~crucible~~ annular space, and recovering ~~other~~ oxides of uranium and plutonium by deposition of the oxides in a mixed state on the surface of the ~~cathode~~ cathodes, after the entire spent nuclear fuel has been dissolved into the molten salt;

wherein in the simultaneous electrolytic step, the vertical pair of the annular anode and the rod-shaped cathodes is used for main electrolysis in which uranium oxide is dissolved and deposited by electrochemical reaction and the parallel pair of the rod-shaped anodes and the rod-shaped cathodes is used for auxiliary electrolysis for suppressing ~~the~~ ununiform uranium oxide electrodeposition, and

wherein in the MOX recovery step, the parallel pair of the rod-shaped anodes and the rod-shaped cathodes is used for main electrolysis in which the MOX is deposited, and the vertical pair of the annular anode and the rod-shaped cathodes is used for auxiliary electrolysis for dissolving ~~the~~ any electrodeposit which has fallen down from the cathodes.

Claim 5. (Currently Amended) A spent nuclear fuel reprocessing method with an oxide electrowinning method by using the electrolytic apparatus according to claim 3, wherein the oxide electrowinning method comprises:

a simultaneous electrolytic step, including dissolving uranium oxide contained ~~in a large amount~~ in a spent nuclear fuel into a molten salt in the annular electrolytic vessel due to an anodic oxidation reaction, and simultaneously recovering uranium oxide by depositing uranium oxide on the surface of the ~~cathode~~ cathodes due to cathodic reduction;

a dissolution step by chlorination in which the electrolytic step is stopped, including dissolving uranium oxide, plutonium oxide and other elements remaining in the spent nuclear fuel into the molten salt by blowing chlorine gas into the molten salt to convert the uranium oxide, the plutonium oxide and other elements remaining in the spent nuclear fuel to chlorides thereof; and

a MOX recovery step, including performing electrolysis between ~~one of the anodes doubling as a crucible~~ and ~~one of the rod-shaped cathodes~~ installed in the upper portion of the ~~crucible~~ annular space, and recovering ~~other~~ oxides of uranium and plutonium by deposition of the oxides in a mixed state on the surface of the ~~cathode~~ cathodes, after the entire spent nuclear fuel has been dissolved into the molten salt;

wherein in the simultaneous electrolytic step, the vertical pair of the annular anode and the rod-shaped cathodes is used for main electrolysis in which uranium oxide is dissolved and deposited by electrochemical reaction and the parallel pair of the rod-shaped anodes and the rod-shaped cathodes is used for auxiliary electrolysis for suppressing ~~the~~ ununiform uranium oxide electrodeposition, and

wherein in the MOX recovery step, the parallel pair of the rod-shaped anodes and the rod-shaped cathodes is used for main electrolysis in which the MOX is deposited, and the vertical pair of the annular anode and the rod-shaped cathodes is used for auxiliary electrolysis for dissolving ~~the~~ any electrodeposit which has fallen down from the cathodes.

## COMMENTS

The claims have been amended to more clearly recite applicant's invention. In the papers filed by applicant on June 30, 2009, applicant amended claims 4 and 5 to recite an anode doubling as a crucible. Paragraph [0005] of applicant's specification indicates that the crucible doubles as the anode in the conventional technique. As pointed out in paragraph [0006] of the specification, this conventional technique has suffered from the problem that in the simultaneous electroplating step, the spent nuclear fuel is placed in the bottom of the crucible which functions as the anode so that the distance between the electrodes is not maintained constant. Consequently, the current density distribution on the surface of the cathode becomes ununiform, resulting in the ununiform distribution of the electrodeposit. In the apparatus recited in claim 2, an annular anode installed at the bottom of the annular space of the annular electrolytic vessel, along with rod-shaped anodes, are provided. There is no recitation that the vessel (crucible) also functions as an anode as in the conventional apparatus of the prior art. Claims 4 and 5, which directly and indirectly depend from claim 2, have been amended to delete the recitation that one of the anodes doubles as the crucible. Claims 4 and 5 refer to the rod-shaped cathodes installed in the upper portion of the crucible. Claim 2 has been amended to recite that the annular space of the annular electrolytic vessel (which serves as a crucible to hold the spent fuel being treated) has an upper portion to provide antecedent basis for this limitation in claims 4 and 5. The word "crucible" in claims 4 and 5 has been changed to "annular space" to be consistent. The claims have additionally been amended to correct minor grammatical errors.

The following is an examiner's statement of reasons for allowance: applicant's Remarks are persuasive with respect to the patentability of the claims as amended.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to WILLIAM T. LEADER whose telephone number is (571) 272-1245. The examiner can normally be reached on Mondays-Thursdays and alternate Fridays, 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/William Leader/  
September 16, 2009

/PATRICK RYAN/  
Supervisory Patent Examiner, Art Unit 1795